Relation between Income Inequality and Economic Growth

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Abstract

This paper analyzes the effect of income inequality on economic growth. World Bank data on countries' growth, GINI index, unemployment, savings, FDI and HDI were used to estimate multiple linear regression models. Eight models were developed to test the hypothesis of a negative relationship between growth and GINI. The models controlled for economic differences between countries. The results showed no significant evidence for the hypothesis, concluding that GINI is more likely to affect growth in the long run; it is difficult to capture this dynamic affect using cross sectional analysis. Variables such as savings, unemployment and investment is shown to be more likely to affect growth in the short run.

1 Introduction

The level of income inequality in a nation has always been an important economic issue for governments to address. Typically, people have taken on the opinion that greater income equality in a country is beneficial because it leads to a significant increase in welfare for all citizens. In the United States specifically, this sentiment has existed for over one hundred years, dating back to low-wage factory jobs. Even to this day, American citizens are upset that there still exists a large divide between the poor and middle classes and the upper echelon or the "1%." In addition to the United States, almost every country in the world has an issue trying to close the gaps of income inequality. Citizens are primarily concerned with their own quality of life, however it is also quite possible that the overall health of the economy and a country's GDP are linked to the level of income inequality in a nation.

It is important that there is a connection between the level of income inequality and GDP because governments most likely would not focus on evenly distributing income if this did not have an overall effect on the economy. The topic of income inequality could be seen as a moral issue, but it should have some impact on a nation's output. One of the most common ways of measuring the level of income inequality in a country is the GINI index, a figure between 0 and 1 where a value of 0 represents a country that perfectly distributes income across the population. While a variety of other factors may be at play when determining a country's growth, the GINI index provides a useful measurement tool to compare many different countries and their respective levels of income inequality and GDP.

Classically, it is believed that an economy experiences an increase in growth when people begin spending and consuming more. If it is assumed that there is a high level of income inequality in a nation, it can also be assumed that there is a relatively small group of people that sit at the very top of the income ladder. These people by themselves cannot effectively consume and spend at a rate that is comparable with the rest of the population. This is why it appears that reducing income inequality will then lead to an increase in growth. If income is distributed more equally, a larger portion of the population will gain the ability to consume and spend more. Theoretically, this increase in spending across the entire population will boost per capita GDP, and if the level of inequality continues to decrease there should be expected increases in growth.

2 Literature Review

Barro (2000) researched the effects that specific factors have on country GDP and he used panel and cross-sectional data from a couple of different data sets as well as time series data concerning inequality over the decades of the 1960s, ‘70s, ‘80s and ‘90s. He first addressed the multiple theories that attempt to explain growth, or the lack thereof. Some of the key things Barro mentions are the ways in which governments can affect overall growth through policies that redistribute wealth, and therefore reduce inequality, as well as the ways in which poor political institutions and social unrest can lead to poor growth. He used a sample that included data on over 100 countries from 1965-1995 and chose regressors such as school attainment, inflation, birth rate, investment and a subjective democracy index to determine how policies and social factors affect growth. In addition to this, he used a different sample that included 84 countries with at least one observation on the GINI coefficient to see how it related to growth and investment rates. Barro arrived at some interesting results, concluding that in countries with relatively low GDPs, growth decreases as inequality increases. On the other hand, in rich countries GDP increases along with inequality.

Deninger and Squire (1998) took a look at inequality and growth with the use of data sets that Barro used in his own research, and thus they have a similar approach to the topic. They primarily focused on data that included differences in income inequality as well as land inequality and they used a sample that included 108 countries with at least one observation on the GINI index. Their dataset also included the shares received by different quintiles in the population, ranging from the bottom 20% to the top 20%, or richest quintile in the country. Due to Barro’s use of some of the same sample data and the inspiration he took from this paper, the conclusions that he made are also present in this work. However, Deninger and Squire elaborate on their findings, indicating that land and income inequality only have a limited effect on growth. They determined that aggregate investment is the most important factor in growth, and along with asset-redistribution this can lead to an increase in the welfare of the poor as well as an increase in growth.

Together, Persson and Tabellini (1994) performed a study that focuses specifically on the effects of income inequality and public policies. They developed models that characterize an individual’s utility, income, consumption, and political preferences in order to provide a variety of testable attributes. The primary hypothesis they set out to test was whether or not a more equal distribution of income and a higher average level of basic skills both increase growth. Interestingly, Persson and Tabellini used data dating back from the 1830s which included 8 countries in Europe as well as the United States. They also included data from the post-World War II period that involved a much larger set of countries due to improved data collection at the time. They measured average skills through data on schooling, and they also included political participation, investment and initial GDP as regressors for growth. Persson and Tabellini had a different take than the previously mentioned authors, concluding that inequality harms growth by leading to policies that do not protect property rights or allow for full appropriation of returns on investment.

In our own personal research we incorporate some of the ideas that are found in the literature as well as focusing on inflation, unemployment, savings, and investment rates within countries to determine the overall effect of income inequality on a nation's growth expectations. One variable that we use ourselves, and that is consistently used across the literature, is the GINI index. As the most commonly used measurement of inequality, the GINI index allows us and other researchers to discover the relationship between income distribution and other factors, like GDP in our case. We deviate from the literature in some ways by leaving out many of the individual-centric variables like the school attainment and birth rate variables that Barro uses as well as indexes for political affiliation which are used by Barro and Persson and Tabellini. We focused more on the broad influencing factors like the correlation between GDP and inflation and the relationship between GDP and unemployment. In addition, we incorporated each country's savings and investment rates in our models as further indicators of economic growth. Overall, we took a more macroeconomic approach to the variables that likely affect GDP along with income inequality. Because of this, we are able to discuss the issue in a way that concentrates on the economy as a whole rather than the idiosyncrasies of the individuals who make up the population.

3 Data

Data from the World Bank was heavily relied upon. Separate Excel spreadsheets from the World Bank website for each variable were downloaded and combined in one final dataset. All spreadsheets were most recently updated in 2018. In addition, data on the Human Development Index (HDI) was retrieved from a 2017 United Nations Development Programme (UNDP) report and added to the dataset. Although the final dataset included 218 countries and non-sovereign regions, only 72 observations indicated the GINI index.

The World Bank GINI estimate is available for different countries in different years. The year 2013 was the most recent year with a relatively high number of GINI observations, 72 to be exact. It is possible to use GINI observations from different years (or take an average over a range of years) for countries were GINI was not estimated in 2013 to increase the number of observations. However, this might introduce sampling bias or introduce other problems to the analysis. Therefore, a year with relatively high GINI observations was selected and used for all other variables as well. It is better practice to use data from the same year in cross sectional analysis to control for global economic changes that happen from year to year.

Variable	Abbreviation	Year	Source
GDP growth rate (annual %)	*growth*	2013	World Bank
GINI index (World Bank estimate)	*gini*	2013	World Bank
Unemployment rate (% of labor force, modeled ILO estimate)	*unemr*	2013	World Bank
Gross savings (current US$)	*sav*	2013	World Bank
Foreign direct investment, net inflows (BoP, current US$)	*fdi*	2013	World Bank
Foreign direct investment, net inflows (% of GDP)	*fdir*	2013	World Bank
Human Development Index (HDI)	*hdi*	2013	United Nations Development Programme (UNDP)

Table 1: Summary of variables

Table 1 lists the variables in the dataset. The GDP growth rate will be considered the dependent variable, and the other variables are considered independent. The World Bank defines the growth rate as the "percentage growth rate of GDP at market prices based on constant local currency." (2018) In other words, this is the real growth rate, and hence, there is no need to account for inflation.

The World Bank also defines: "GINI index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household. The GINI index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus a GINI index of 0 represents perfect equality, while an index of 100 implies perfect inequality." (2018)

The GINI index is the main explanatory variable of interest. The hypothesis is that there is a negative relationship between GINI and growth. Holding all other things constant, lower income inequality usually indicates higher standard of living for a larger proportion of the population. Therefore, it seems likely that such a country would be more productive and possibly more innovative. Productivity and innovation are important drivers of economic growth. To successfully test this hypothesis, all other variables affecting growth that are also correlated with GINI must be controlled for by specifying it in the model.

The unemployment rate in a given country is clearly correlated with GINI. Furthermore, it can affect growth. Countries at full employment find it hard to grow in the short run. Given a certain productivity level, no growth can be achieved in the short run without hiring workers. Low unemployment make it hard to hire workers as wages are higher and the labor market is tight.

Savings are important for growth. As more income is saved, more funds are available for investment. More investments push growth. Savings is also likely to be correlated with GINI, as people with higher and higher incomes save more proportional to their income.

Foreign direct investment (FDI) refers to direct investment equity flows into an economy. FDI pushes growth with new investment.

According to the UNDP, “The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions.” (2017). This affects growth through two channels. The first is that higher HDI generally indicates a better trained workforce that is more productivity. Increase in productivity directly translates to an increase in output, growth. The other channel is that as a country becomes more developed and more productive, it experiences lower returns to capital. This would mean it is harder for countries with higher HDI to grow, holding all other things constant. It is unclear which effect is larger, but including HDI in the model will control for such an important factor.

Other variables such as GDP, ln(GDP), GDP per capita and GDP per capita PPP seem important to specify in the model. These would control for differences in the standard of living and can show the difference between a population which is equally poor or equally rich. However, using them as repressors in the models showed insignificant coefficients and no correlation. Furthermore, using HDI as a measure of the standard of living can eliminate this problem. For information on what the HDI captures, refer to Appendix C.

Variable	Observations	Mean	S.D.	Min.	Max.
growth	199	3.42%	5.55%	-36.70%	34.21%
gini	72	36.55	7.60	24.6	52.9
unemr	188	8.34%	6.23%	.27%	29%
sav	161	$121 billion	$463 billion	-$10.9 billion	$4,670 billion
fdi	202	$10.7 billion	$39.8 billion	-$28.4 billion	$329 billion
fdir	192	4.77%	9.71%	-25.02%	102.68%
hdi	187	0.696	0.155	.34	.946

Table 2: Summary statistics of variables. See Table 1 for full variable names.

Summary statistics for the described variables are shown in Table 2. The most notable observation is the huge variation in FDI and savings. These are expected across countries. The especially extreme values of savings suggest that taking its log when regressing would yield better results. Negative savings means a country consumes more than it produces. Negative FDI indicates net capital outflows from a specific country. Scatter plots of growth versus each of these variables are included in Appendix A.

Given these variables, the models under consideration are the following:

Model 1: $growth = \beta_0 + \beta_1 gini + u$

Model 2: $growth = \beta_0 + \beta_1 gini + \beta_2 unemr + u$

Model 3: $growth = \beta_0 + \beta_1 gini + \beta_2 unemr + \beta_3 \ln(sav) + u$

Model 4: $growth = \beta_0 + \beta_1 gini + \beta_2 unemr + \beta_3 \ln(sav) + \beta_4 \ln(fdi) + u$

Model 5: $growth = \beta_0 + \beta_1 gini + \beta_2 unemr + \beta_3 \ln(sav) + \beta_4 fdir + u$

Model 6: $growth = \beta_0 + \beta_1 gini + \beta_2 unemr + \beta_3 \ln(sav) + \beta_4 fdir + \beta_5 hdi + u$

When running multiple linear regression, it is important to consider the five Gauss Markov Assumptions and whether or not it is safe to assume them in a particular application. The first assumption, linearity in parameters, is absolutely satisfied by the explicit specification of the models. The second assumption, random sampling, should be safe to assume in this case since data is obtained from the World Bank. However, some caution should be taken since only 72 countries had GINI estimates. The third assumption is that there is not perfect collinearity between the explanatory variables. Given the models specified above, this should be safe to assume.

The fourth assumption, having a zero conditional mean of the error term, cannot be assumed if the model suffers from omitted variable bias. This could be an issue in the models above since they don't include any GDP derived standard of living indicators. However, as discussed, it proved difficult to include GDP or GDP per capita as an independent variable since it makes the results of the regression insignificant. Other variables that influence growth, vary widely by country and can be correlated with other regressors might have been unintentionally omitted. Knowing this assumption isn't necessarily satisfied indicates that we should interpret the results with caution. Nevertheless, Model 6 does capture standard of living by using the HDI as a regressor. It is therefore the least prone to omitted variable bias and closer to satisfying assumption 4 than others.

These four assumptions are sufficient to have unbiased coefficients. However, for the estimators to be considered the best linear unbiased estimators, the fifth assumption must be included: homoscedasticity.

4 Results

The software package Stata was used to run the regression on the data. The results of the regression models are summarized in Table 3 on the next page. The Stata output is included in Appendix B.

The first model, the simple linear regression, shows a significant positive relationship between GINI and growth. Although this goes against the hypothesis, it is expected. Many high growth countries happen to have higher inequality due to other factors. This correlation does not imply causality.

Adding the unemployment rate, and then the log of savings, also produce highly significant coefficients. However, the coefficient on GINI is decreasing, going more and more in the direction of the negative correlation hypothesis. These are better estimates than the simple linear regression model, but the coefficient on GINI is still positive. Controlling for more variables such as FDI and the standard of living should produce more intuitive results.

Dependent Variable: Growth Rate							
		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Independent Variables	GINI Index	0.136*** (0.048)	0.120*** (0.045)	0.115*** (0.043)	0.104** (0.043)	.116*** (0.042)	.075 (0.048)
	Unemployment Rate	-	-0.202*** (0.059)	-0.231*** (0.056)	-0.212*** (0.055)	-.225*** (.055)	-0.226*** (0.065)
	ln(Savings)	-	-	-0.541*** (0.158)	-0.712** (0.282)	-0.532*** (0.156)	-0.335* (0.192)
	ln(FDI)	-	-	-	0.139 (0.293)	-	-
	FDI Rate	-	-	-	-	0.075* (0.043)	0.078* (0.042)
	HDI	-	-	-	-	-	-6.46 (4.20)
Constant Term		-2.24 (1.79)	0.090 (1.83)	13.6*** (4.32)	15.1*** (4.15)	13.0*** (4.26)	14.9*** (4.39)
Observations		71	68	65	59	65	64
R-Squared		10.4%	25.3%	37.7%	41.3%	40.8%	45.3%
Standard errors indicated in parentheses * coefficient significant at 10%, ** at 5%, *** at 1%							

Table 3: Results of the multiple linear regression models. Estimated slope coefficients are indicated for the independent variables included in each model.

The fourth and fifth model are helpful in seeing which measure of FDI is better at explaining growth in this context. The FDI rate, as a percentage of GDP, has a significant coefficient as apposed to the log of FDI. This captures the relation between growth and FDI more clearly and hence it is accepted as a more accurate model. The coefficient on GINI is still positive however, which is not expected. This is most likely due to omitting the standard of living as a variable.

Including HDI as a measure of both human capital and the standard of living is expect to resolve the omitted variable bias. Model 6 shows the results of including FDI. Now, the coefficient on GINI is not significant, meaning that GINI does not predict growth. Likewise, the coefficient of HDI in not significant. In addition, this result indicates that more inequality is not likely to cause more growth, unlike the previous models.

The results don't support the hypothesis of a negative correlation between GINI and growth. Robustness tests should be performed on Model 6 for further investigation. In addition, one reason this analysis might not be suitable for testing the hypothesis is that the analysis is cross sectional, whereas the hypothesis stresses dynamic effects that might not be apparent in the short run. Growth is affected by different factors in different time frames. For example, whereas savings help accumulate capital, and therefore, boosts output, capital is fairly constant in the short run and an increase in savings decreases demand, and therefore, decreases output in the short run. The results of the regression models actually show this, as savings are always negatively related to growth, highlighting the short term, fall in demand effect. Innovation, education, productivity and better institutions, factors we expect to improve with more income equality, affects growth more clearly in the long run. A time series analysis that measures the effect of change in GINI on growth in the long run could produce more interesting results.

5 Extensions

5.1 Robustness Tests

Two F-tests will be performed on Model 6; the first has the following hypotheses:

$$H_0: \beta_{\ln(sav)} = \beta_{\text{fdir}} = 0$$
$$H_1: H_0 \ \ not\ true$$

This first test checks whether or not the effects of saving and FDI rate are jointly significant. Although they are individually significant at 10%, it is not necessary for them to be jointly significant. The Following formula calculates the F-statistic for this first test:

$$F_{stat} = \frac{(SSR_r - SSR_{ur})/q}{SSR_{ur}/(n-k-1)} = \frac{(434.6 - 361.3)/2}{316.3/(64-5-1)} = 5.88$$

Where the restricted model is the regression of *growth* on *gini*, *unemr* and *hdi*. The unrestricted model is Model 6 as is. The F-statistic value of 5.88 is higher than the critical value at the 5% significance level, which is 3.16. This shows that the two are jointly significant and the null hypothesis can be rejected.

The second F-test tests whether or not the coefficients on GINI and HDI are jointly significant. Formally, we test against the following hypotheses:

$$H_0: \beta_{gini} = \beta_{hdi} = 0$$

$$H_1: H_0 \ \ not\ true$$

The equation and calculation for the F test statistic is given by:

$$F_{stat} = \frac{(SSR_r - SSR_{ur})/q}{SSR_{ur}/(n-k-1)} = \frac{(1360.3 - 361.3)/3}{361.3/58} = 53.46$$

At the 5% confidence level, with numerator degrees of freedom equal to 3 and denominator degrees of freedom equal to 58, the critical value for the F-test is 2.76. The F-statistic is extremely high and the null hypothesis can be safely reject. This shows that *gini* and *hdi* are jointly very significant. The reason they are not individually significant at 10% but jointly significant at 5% can be a problem of multi-collinearity.

5.2 Developed and Developing Countries

It could be helpful to run the regression on two groups of countries: developed and developing. Due to economic similarity in the drivers of growth within each of these groups, this could reduce any omitted variable bias.

There is no clear cut definition of what constitutes a developed versus a developing country. One practical measure is to consider OECD members as developed countries. Another criteria is to consider countries with HDI above 0.8 as developed countries. See Appendix A, Figures 7 and 8 for scatter plots showing growth and GINI for developed countries according to the two definitions.

Model 5 is run twice more with a dummy variable indicating 1 for a developed country, 0 for the contrary, each time according to one of the definitions definition. Model 5 is chosen rather than Model 6 because the variable HDI is very likely to collinear with the dummy variables. The results are summarized in Table 4 on the next page. See appendix B for the Stata output of the regression.

Dependent Variable: Growth Rate				
		Model 5	Model 5a	Model 5b
Independent Variables	GINI Index	.116*** (0.042)	.088* (.048)	.040 (.046)
	Unemployment Rate	-.225*** (.055)	-.206*** (.057)	-.151*** (.057)
	ln(Savings)	-0.532*** (0.156)	-.404** (.186)	-.317* (.161)
	FDI Rate	0.075* (0.043)	.083* (0.043)	.076* (.040)
	OECD	-	-1.08 (.860)	-
	HDI > 0.8	-	-	-2.57*** (.818)
Constant Term		13.0*** (4.26)	11.2** (4.47)	11.46*** (4.01)
Observations		65	65	65
R-Squared		40.8%	42.3%	49.2%
Standard errors indicated in parentheses * coefficient significant at 10%, ** at 5%, *** at 1%				

Table 4: Results of Model 5 regression and 5a and 5b, where 5a includes a dummy variable taking a value of 1 for OECD member and 0 otherwise. Model 5b includes a dummy variable taking a value of 1 when HDI is greater than or equal to .8 and 0 otherwise. Estimated slope coefficients are indicated for the independent variables included in each model.

The results for Model 5a show that being an OECD member doesn't significantly affect growth. This is not surprising as exclusively choosing OECD members as developing countries is economically arbitrary. The coefficient on GINI is still positive, but less significant. The results of Model 5b, however, are much more interesting. The dummy variable has very significant negative coefficient, indicating that developed countries do indeed grow less, probably due to diminishing returns to capital. The coefficient on GINI is not significant, showing that GINI does not affect growth in the short run. Unemployment is negatively related to growth; this is likely due to the fact that economies in recession lay off workers. The causality is backwards: low or negative growth causes high unemployment. The effect of full employment restricting growth is dynamic and probably does not appear in cross sectional analysis.

6 Conclusion

In the short run, there seems to be no evidence that supports any correlation between growth and income inequality. The hypothesized negative correlation depends on dynamic processes that need time series analysis to investigate. The saving rate and foreign direct investment do better at explaining growth in the short run.

Our models may have suffered from omitted variable bias. Our focus was on medium-long run drivers of growth. Short run drivers of growth such as demand, prices of inputs, investment and the size of the services and/or financial sectors relative to the whole economy of a country should be investigated further.

Income inequality is a problem many people feel on a day to day basis. It seems that it hinders the ability to get a better education and a better life for a larger proportion of the population. Under such conditions, people are less productive, and potential for economic growth is not taken advantage of. Whether or not reducing inequality makes the economic pie larger is a question that is surely to be debated for years to come.

References

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Appendix A

Scatter Plots

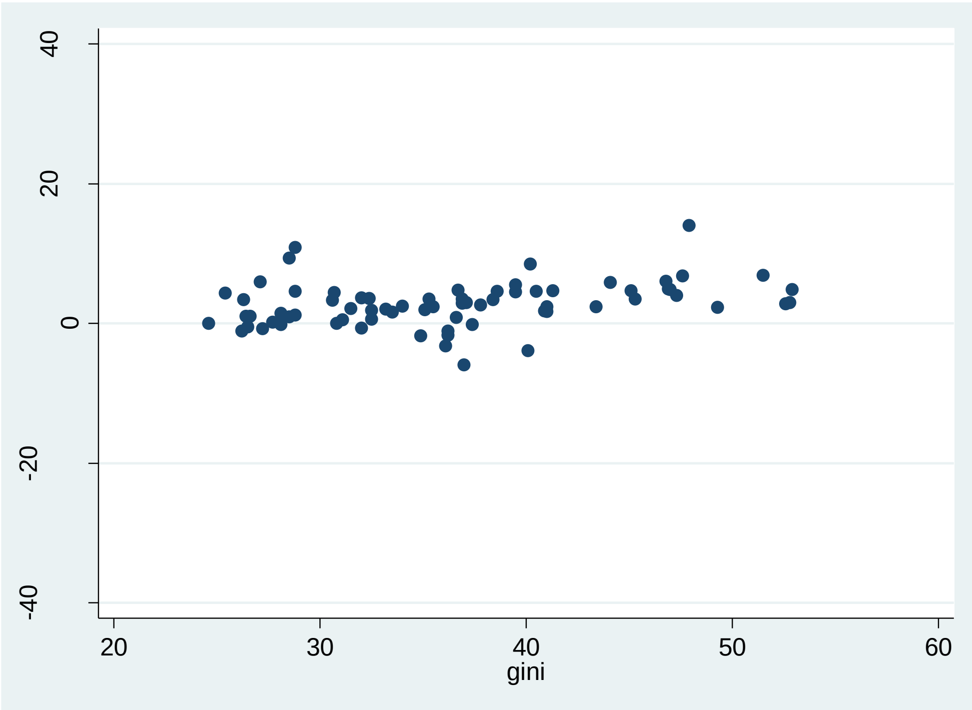

Figure 1: GDP growth rate and the GINI index

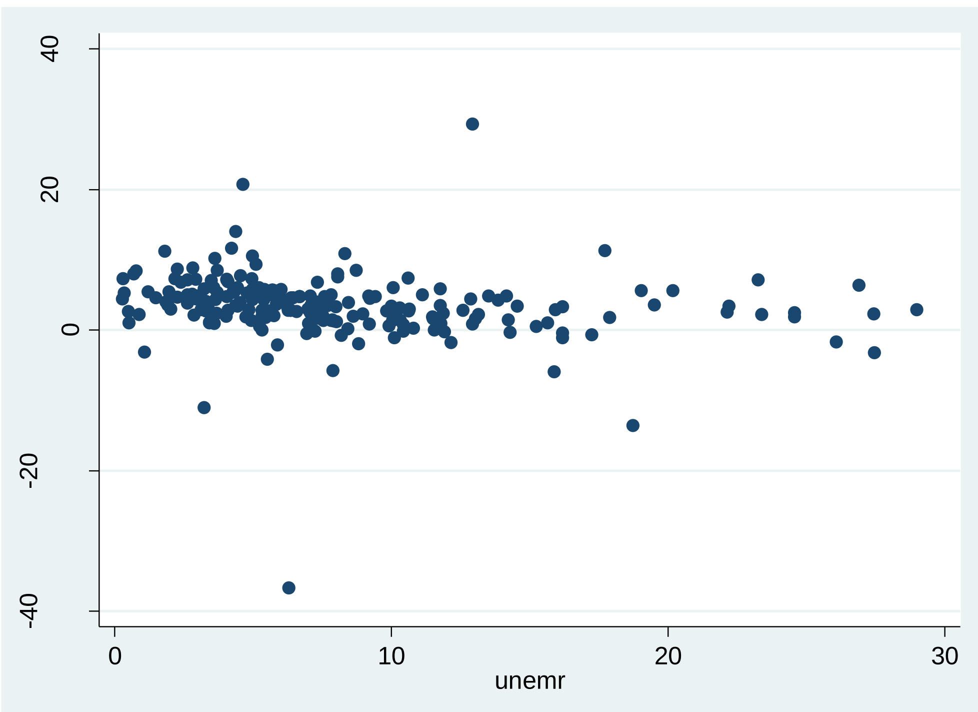

Figure 2: GDP growth rate and unemployment rate

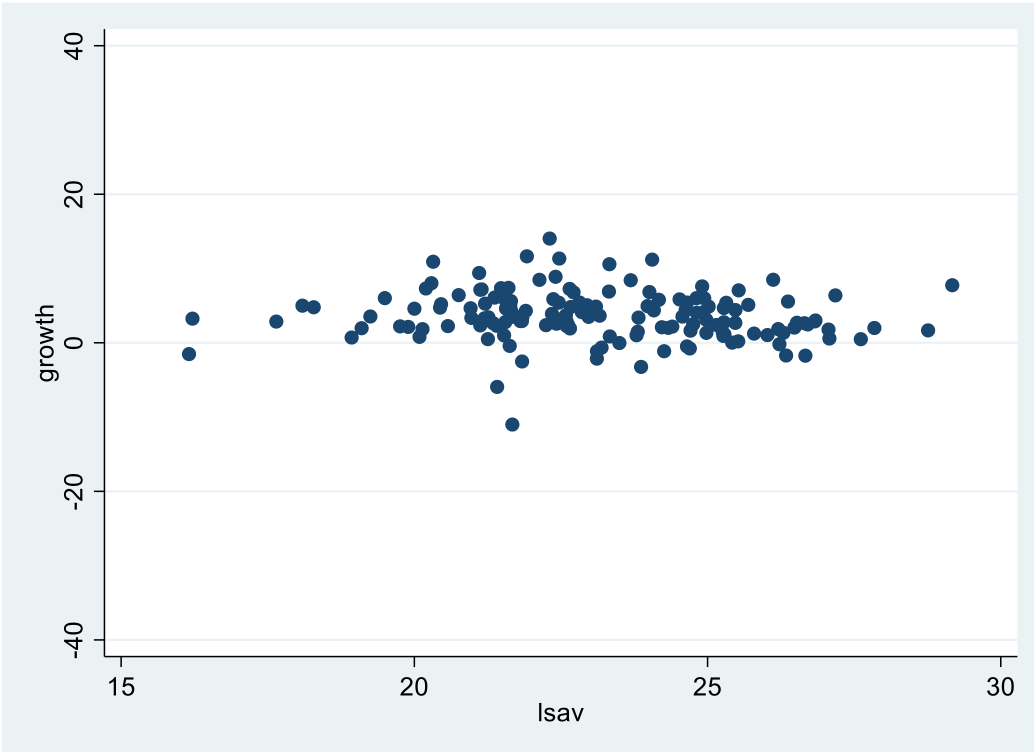

Figure 3: GDP rate and ln(saving)

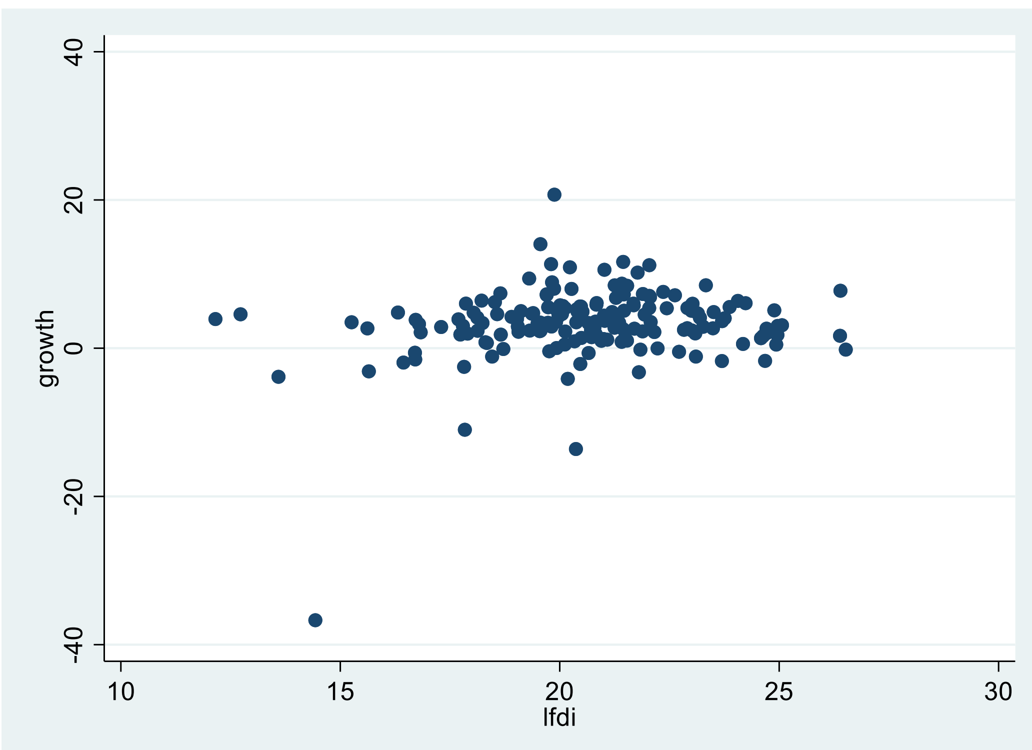

Figure 4: GDP growth rate and ln(FDI)

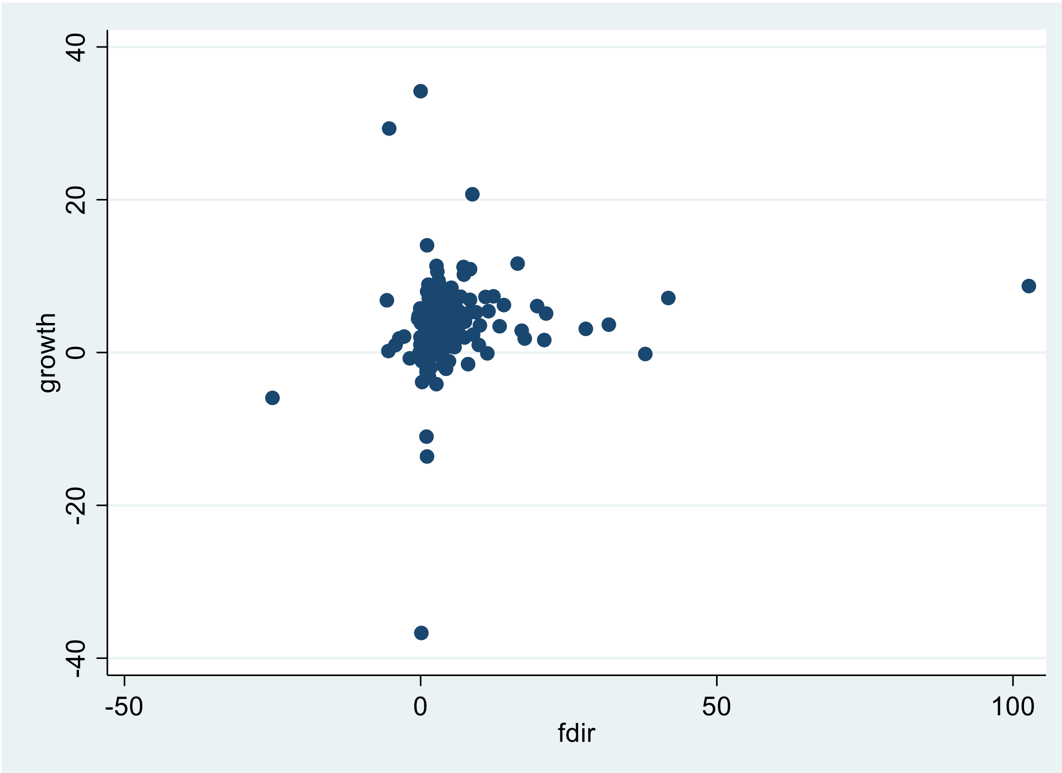

Figure 5: GDP growth rate and FDI rate

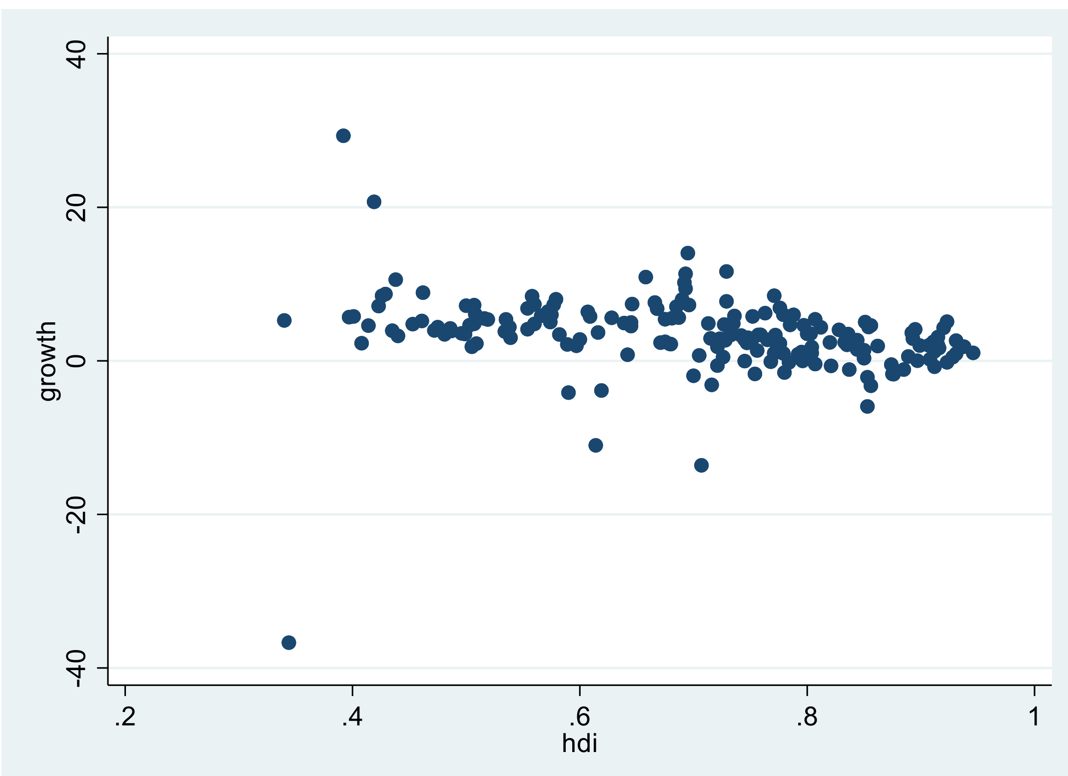

Figure 6: GDP growth rate and HDI

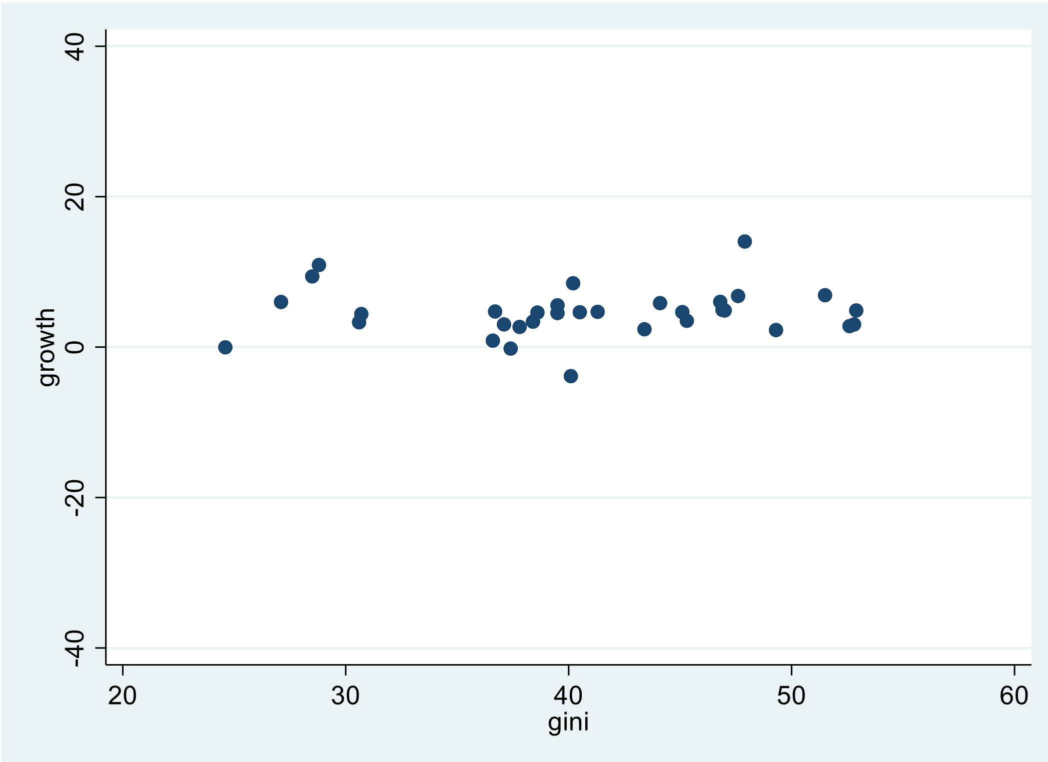

Figure 7: GDP growth and GINI for countries with HDI > 0.8

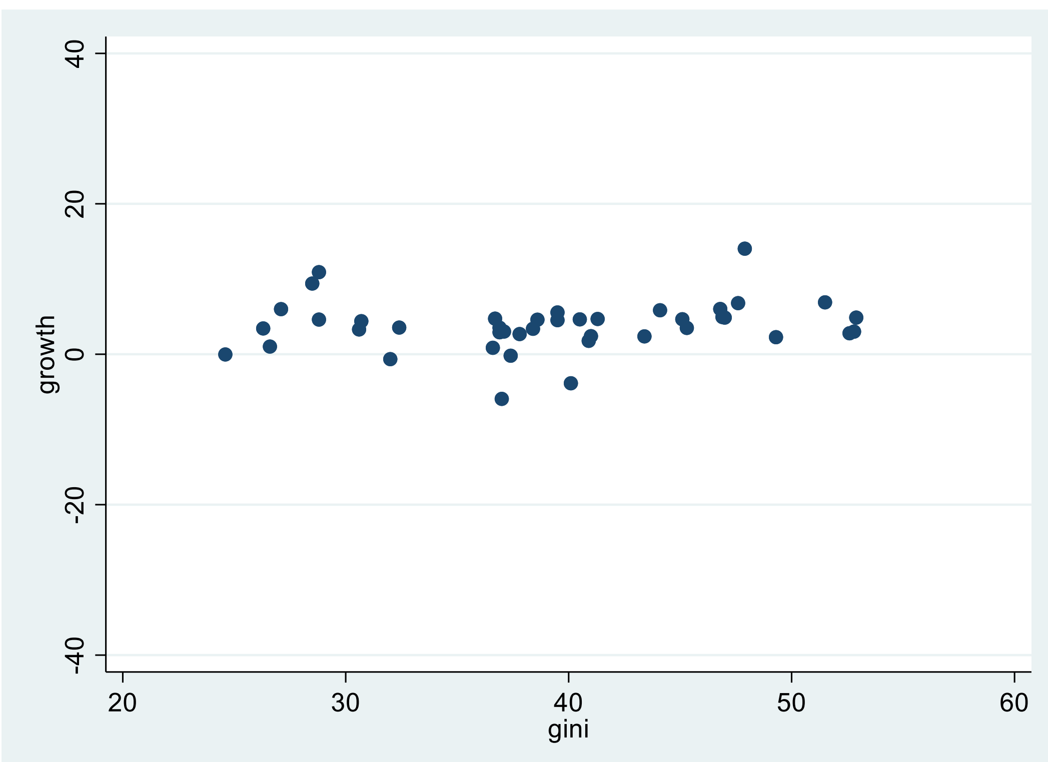

Figure 8: GDP growh and GINI for OECD members

Appendix B

Stata Output

```
. regress growth gini

      Source |       SS           df       MS      Number of obs   =        71
-------------+----------------------------------   F(1, 69)        =      7.97
       Model |  75.0861588         1  75.0861588   Prob > F        =    0.0062
    Residual |  649.768805        69   9.4169392   R-squared       =    0.1036
-------------+----------------------------------   Adj R-squared   =    0.0906
       Total |  724.854964        70  10.3550709   Root MSE        =    3.0687

------------------------------------------------------------------------------
      growth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        gini |   .1363172   .0482754     2.82   0.006     .0400105     .232624
       _cons |  -2.235488   1.796697    -1.24   0.218    -5.819801    1.348825
------------------------------------------------------------------------------
```

```
. regress growth gini unemr

      Source |       SS           df       MS      Number of obs   =        68
-------------+----------------------------------   F(2, 65)        =     11.02
       Model |  169.714506         2  84.8572528   Prob > F        =    0.0001
    Residual |  500.315121        65  7.69715571   R-squared       =    0.2533
-------------+----------------------------------   Adj R-squared   =    0.2303
       Total |  670.029627        67  10.0004422   Root MSE        =    2.7744

------------------------------------------------------------------------------
      growth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        gini |   .1204578   .0454076     2.65   0.010     .0297724    .2111431
       unemr |  -.2017175   .0586652    -3.44   0.001      -.31888   -.0845551
       _cons |   .0902137   1.825104     0.05   0.961    -3.554771    3.735199
------------------------------------------------------------------------------
```

```
. regress growth gini unemr lsav

      Source |       SS           df       MS      Number of obs   =        65
-------------+----------------------------------   F(3, 61)        =     12.32
       Model |  249.288936         3  83.0963121   Prob > F        =    0.0000
    Residual |  411.296018        61  6.74255767   R-squared       =    0.3774
-------------+----------------------------------   Adj R-squared   =    0.3468
       Total |  660.584954        64  10.3216399   Root MSE        =    2.5966

------------------------------------------------------------------------------
      growth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        gini |   .1150099   .0429855     2.68   0.010     .0290551    .2009646
       unemr |  -.2313385   .0561515    -4.12   0.000    -.3436203   -.1190567
        lsav |  -.5414213   .1584454    -3.42   0.001    -.8582524   -.2245901
       _cons |   13.61299   4.323139     3.15   0.003     4.968343    22.25764
------------------------------------------------------------------------------


. regress growth gini unemr lsav lfdi

      Source |       SS           df       MS      Number of obs   =        59
-------------+----------------------------------   F(4, 54)        =      9.49
       Model |  228.965762         4  57.2414406   Prob > F        =    0.0000
    Residual |  325.707289        54  6.03161646   R-squared       =    0.4128
-------------+----------------------------------   Adj R-squared   =    0.3693
       Total |  554.673051        58  9.56332847   Root MSE        =    2.4559

------------------------------------------------------------------------------
      growth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        gini |   .1043252   .0434353     2.40   0.020     .0172426    .1914079
       unemr |  -.2115527   .0547482    -3.86   0.000    -.3213163   -.1017891
        lsav |  -.7116908   .2820842    -2.52   0.015    -1.277236    -.146146
        lfdi |    .138725   .2934469     0.47   0.638    -.4496006    .7270506
       _cons |   15.07768   4.145187     3.64   0.001     6.767081    23.38828
------------------------------------------------------------------------------
```

`. regress growth gini unemr lsav fdir`

Source	SS	df	MS			
				Number of obs	=	65
				F(4, 60)	=	10.33
Model	269.362263	4	67.3405657	Prob > F	=	0.0000
Residual	391.222691	60	6.52037818	R-squared	=	0.4078
				Adj R-squared	=	0.3683
Total	660.584954	64	10.3216399	Root MSE	=	2.5535

growth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gini	.1162011	.0422768	2.75	0.008	.031635	.2007672
unemr	-.2246821	.0553487	-4.06	0.000	-.3353961	-.1139681
lsav	-.532292	.1558999	-3.41	0.001	-.8441381	-.2204458
fdir	.0749916	.0427405	1.75	0.084	-.0105021	.1604853
_cons	13.02475	4.264513	3.05	0.003	4.494453	21.55505

`. regress growth gini unemr lsav fdir hdi`

Source	SS	df	MS			
				Number of obs	=	64
				F(5, 58)	=	9.61
Model	299.264044	5	59.8528087	Prob > F	=	0.0000
Residual	361.30537	58	6.22940292	R-squared	=	0.4530
				Adj R-squared	=	0.4059
Total	660.569413	63	10.4852288	Root MSE	=	2.4959

growth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gini	.0746095	.0478275	1.56	0.124	-.0211276	.1703466
unemr	-.2258231	.0652687	-3.46	0.001	-.3564726	-.0951736
lsav	-.3350777	.1919753	-1.75	0.086	-.7193579	.0492026
fdir	.0777959	.0419182	1.86	0.069	-.0061125	.1617043
hdi	-6.456916	4.202981	-1.54	0.130	-14.8701	1.956264
_cons	14.88818	4.338513	3.43	0.001	6.203703	23.57266

```
. regress growth gini unemr lsav fdir oecd
```

Source	SS	df	MS			
				Number of obs	=	65
				F(5, 59)	=	8.66
Model	279.633277	5	55.9266554	Prob > F	=	0.0000
Residual	380.951683	59	6.45680818	R-squared	=	0.4233
				Adj R-squared	=	0.3744
Total	660.58496	64	10.32164	Root MSE	=	2.541

growth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gini	.0881757	.0475778	1.85	0.069	-.0070274	.1833787
unemr	-.2055994	.0571186	-3.60	0.001	-.3198935	-.0913053
lsav	-.4037902	.1856029	-2.18	0.034	-.7751807	-.0323996
fdir	.0827599	.0429753	1.93	0.059	-.0032334	.1687533
oecd	-1.084633	.8599742	-1.26	0.212	-2.805438	.6361712
_cons	11.24822	4.471332	2.52	0.015	2.301104	20.19533

```
. regress growth gini unemr lsav fdir developed
```

Source	SS	df	MS			
				Number of obs	=	65
				F(5, 59)	=	11.44
Model	325.210482	5	65.0420965	Prob > F	=	0.0000
Residual	335.374477	59	5.68431317	R-squared	=	0.4923
				Adj R-squared	=	0.4493
Total	660.58496	64	10.32164	Root MSE	=	2.3842

growth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gini	.0398075	.0463912	0.86	0.394	-.053021	.1326361
unemr	-.1512588	.0567395	-2.67	0.010	-.2647944	-.0377232
lsav	-.3171875	.1609278	-1.97	0.053	-.6392032	.0048283
fdir	.0762743	.0399084	1.91	0.061	-.0035823	.1561309
developed	-2.565176	.8183734	-3.13	0.003	-4.202737	-.9276143
_cons	11.45553	4.013082	2.85	0.006	3.425376	19.48569

. regress growth gini unemr lsav fdir oecd

Source	SS	df	MS		
				Number of obs	= 65
				F(5, 59)	= 8.66
Model	279.633277	5	55.9266554	Prob > F	= 0.0000
Residual	380.951683	59	6.45680818	R-squared	= 0.4233
				Adj R-squared	= 0.3744
Total	660.58496	64	10.32164	Root MSE	= 2.541

growth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gini	.0881757	.0475778	1.85	0.069	-.0070274	.1833787
unemr	-.2055994	.0571186	-3.60	0.001	-.3198935	-.0913053
lsav	-.4037902	.1856029	-2.18	0.034	-.7751807	-.0323996
fdir	.0827599	.0429753	1.93	0.059	-.0032334	.1687533
oecd	-1.084633	.8599742	-1.26	0.212	-2.805438	.6361712
_cons	11.24822	4.471332	2.52	0.015	2.301104	20.19533

. regress growth gini unemr lsav fdir developed

Source	SS	df	MS		
				Number of obs	= 65
				F(5, 59)	= 11.44
Model	325.210482	5	65.0420965	Prob > F	= 0.0000
Residual	335.374477	59	5.68431317	R-squared	= 0.4923
				Adj R-squared	= 0.4493
Total	660.58496	64	10.32164	Root MSE	= 2.3842

growth	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gini	.0398075	.0463912	0.86	0.394	-.053021	.1326361
unemr	-.1512588	.0567395	-2.67	0.010	-.2647944	-.0377232
lsav	-.3171875	.1609278	-1.97	0.053	-.6392032	.0048283
fdir	.0762743	.0399084	1.91	0.061	-.0035823	.1561309
developed	-2.565176	.8183734	-3.13	0.003	-4.202737	-.9276143
_cons	11.45553	4.013082	2.85	0.006	3.425376	19.48569

Appendix C

Human Development Index (HDI)

The following statement and image was retrieved form the UNDP website:

"The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone. The HDI can also be used to question national policy choices, asking how two countries with the same level of GNI per capita can end up with different human development outcomes. These contrasts can stimulate debate about government policy priorities.

"The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions.

"The health dimension is assessed by life expectancy at birth, the education dimension is measured by mean of years of schooling for adults aged 25 years and more and expected years of schooling for children of school entering age. The standard of living dimension is measured by gross national income per capita. The HDI uses the logarithm of income, to reflect the diminishing importance of income with increasing GNI. The scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean."

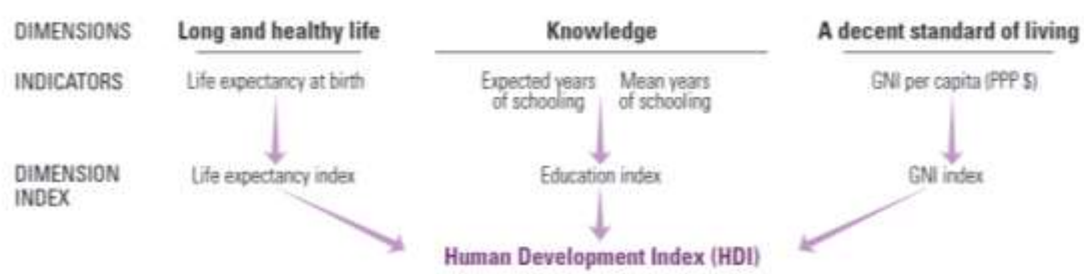

Figure 9: HDI, image courtesy of United Nations Development Programme

URL: http://hdr.undp.org/en/content/human-development-index-hdi

Accessed on November 29th, 2018.